

PORTABLE INFORMATION APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2002-011312, filed Jan. 21, 2002, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a portable information apparatus with a liquid-crystal display device

2. Description of the Related Art

A portable information apparatus, such as a laptop or a notebook computer or a word processor, is roughly composed of two units as shown in perspective views of FIGS. 7A and 7B. FIG. 7A shows the opened state of the apparatus and FIG. 7B shows the closed state of the apparatus. Specifically, one unit is a body 131 which has the function of inputting, processing, and storing information. The other unit is a display section 133 which has a display screen 132 for displaying information. The body 131 and the display section 133, which are connected electrically with an FPC (Flat Package Cable), electric wires, or the like, are capable of displaying the information from the body freely on the display section 133.

The body 131 and the display section 133 are connected via hinge parts 134 in such a manner that they can be opened and closed freely. The hinge parts 134, whose configuration is shown in FIG. 8, are fixed to the body 131. The display section 133 can therefore be opened and closed freely to the body 131 as needed. Giving suitable friction to the rotating sections of the hinge parts 134 makes it possible to keep the opening angle of the display section 133. That is, the user of the portable information apparatus can do setting, with the display section 133 inclined at an easy-to-see, easy-to-use angle. When the user doesn't use the portable information apparatus, he or she can close the display section 133 in such a manner that the display screen 132 is housed inside the apparatus. As a result, the fragile display screen 132 can be protected.

FIG. 9 is an exploded view of the display section 133. As shown in FIG. 9, the display section 133 is generally composed of a liquid-crystal display device 135 from an energy-saving viewpoint. To protect the liquid-crystal display device 135 from external forces, such as push or drop impact, the display device 135 is contained in a housing 136. The housing 136 is formed in a resin mold made of PC/ABS resin or carbon-fiber-added, glass-fiber-added, or inorganic filler-added PC/ABS resin. Alternatively, the housing 136 is made of magnesium alloy or aluminium alloy. The housing 136 is composed of a cover housing 137 for protecting the surfaces of the liquid-crystal display device 135 excluding the display screen 132 and a frame housing 138 for protecting the periphery of the display screen 132. The liquid-crystal display device 135 is fixed to the cover housing 136 by means of hinge metal fittings 139.

With the body 131 engaged with the display section 133, when the display section 133 is opened, if the hinge metal fittings 139 are supported only by the hinge parts 134, great resistance is produced at the supporting sections, because the supporting sections at which the hinge parts 134 support the display section 133 are short. Consequently, stress is

concentrated at the roots of the cover housing 137 supported by the hinge parts 134. Therefore, the repeated opening and closing of the display section 133 can do damage to the roots of the cover housing 137. To avoid this problem, the hinge metal fittings 139 are used structurally so as to act as what is obtained by lengthening the supporting sections of the hinge parts 134 in the direction in which the display section 133 is supported. That is, the cover housing 137 is supported in such a manner that not only area A but also area B of the hinge metal fitting can receive the load imposed when the display section 133 is opened. The hinge metal fitting 139 is formed by cutting a metal plate and bending the resulting plate. In this case, area A screwed to the hinge part 134 provided on the body 131 side and area B mechanically connected to the cover housing 137 and liquid-crystal display device 135 are formed in such a manner that area A and area B are perpendicular to each other. Area B is located in the spacing between the cover housing 137 and the liquid-crystal display device 135 at right and left with respect to the display screen. Area B is screwed to the cover housing 137 and liquid-crystal display device 135 at a plurality of places or is fastened to the latter in a similar manner. The screwed section of area A also has the function of preventing damage.

FIG. 10 is a schematic diagram to help explain the fixing structure using the hinge metal fittings 139. The liquid-crystal display device 135 has two fastening sections formed at symmetrical positions on the side faces. On one side-face side, the fastening section close to the hinge is screwed via the hinge metal fitting 139 to the cover housing 137. On the other side-face side, the fastening section is screwed directly to the cover housing 137 without a hinge metal fitting 139. On the other side-face side, a projecting spacer 140 (shown in FIGS. 11C and 11D explained later) formed at the side face of the liquid-crystal display device 135 is inserted into an engaging hole made in the cover housing 137 and hinge metal fitting 139, thereby engaging with the hole.

FIGS. 11A to 11D are plan views and side views to help explain fastening methods at the fastening sections. The fastening methods are roughly divided into the following three types: (1) a method of fastening the cover housing 137, hinge metal fitting 139, and the liquid-crystal display device 135 together, (2) a method of screwing the liquid-crystal display device 135 and the cover housing 137, and the cover 137 together, and (3) a method of allowing the liquid-crystal display device 135 to move in a specific direction with respect to the hinge metal fitting 139 and cover housing 137.

FIGS. 11A and 11B show the method in item (1). A hole whose diameter is larger than the thread's outside diameter of a screw 141 and smaller than the head of the screw 141. The screw 141 is screwed into a female screw formed at the side face of the liquid-crystal display device 135. At the cover housing 137 of the screw fastening section, a pedestal 143 is formed from a concave portion of a rib 142 so as to prevent the head of the screw from projecting from the cover housing.

FIGS. 12A and 12B show the method in item (2). Since the hinge metal fitting 139 extends only to half of the right and left side faces of the liquid-crystal display device 135, the liquid-crystal display device 135 and the cover housing 137 are screwed together directly at a place to which the screwed section of area A does not reach.

FIGS. 13A, 13B, 14A, and 14B show the method in item (3).

To absorb the variation of tolerance in the liquid-crystal display device 135, the screwing of the liquid-crystal display device 135 and the cover housing 137 used in item (1) and